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USE OF LAWN CHEMICALS IN THE TWIN CITIES

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minnesota water resources research center

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EXECUTIVE SUMMARY

Regulations affecting the use and sale of agricultural chemicals have increased in number and complexity in recent years, in recognition of the potentially adverse effects that improper use can have on soil, water, plant, and human ecosystems. Many of these chemicals are distributed in urban areas for use by the general public on lawns. To date, these nonagricultural uses have received relatively less scrutiny than farm uses. Yet lawn chemical in urban areas use brings these products into closer contact with humans and animals than occurs in many farming areas. Urban landscapes are specifically designed to direct runoff into surface water systems through drains, gutters and storm sewers, making the impact of lawn chemical use of particular interest to those charged with monitoring surface water quality in the Mississippi River system and the more then 400 lakes in the Twin Cities area.

A survey of residents of the Twin Cities area was conducted to gather data and information about use of lawn care chemicals, including fertilizers and pesticides. To the authors knowledge, this is one of the first such efforts in the nation, and the first in the Twin Cities. This study contains estimates, based on survey results, of the total quantities of fertilizers and pesticides applied in the metro area, as well as a summary and interpretation of several factors indicated by the survey that could have significant ramifications for public policy. We stress that these data represent only an initial attempt to learn more about urban lawn chemical use, and suggest the importance of follow up studies.

PRINCIPAL FINDINGS

- Use of lawn fertilizer used in the Twin Cities in 1990 averaged approximately 36 lbs. per household. Those respondents who applied fertilizer used about 27 percent less than the amount recommended by some turf specialists, and 28 percent of respondents used none at all.

- While more information on pesticide applications would be desirable, the survey indicated application rates which are similar to non-urban agricultural use.

- The quantities of lawn chemicals purchased are not strongly responsive to changes in their price, suggesting that public policies designed to raise this price through taxes or fees would not substantially reduce the quantities demanded (although they would raise revenues). Hence a "pollution tax" applied to lawn chemicals will not be effective in reducing use unless it is very large.

- Attitudes of residents in the metro area toward ground and surface water pollution are very similar to those sampled in an earlier survey of farmers (MCSR, 1990). This indicates the existence of a broad consensus of opinion from which public policy regarding chemicals can be crafted. Both urban and rural residents support limitations to reduce the harmful effects of agricultural chemicals.

- Results of a subsample of respondents living on or near Lake Minnetonka indicate that applications of fertilizer may be much lower there than in the metro area as a whole, suggesting sensitivity of residents in an area vulnerable to water quality damages to the impacts of lawn chemical use.

RECOMMENDATIONS

- **Regulation.** While we are unable, as a result of this work, to show a need for strict regulation, we are able to show that "pollution taxes" would likely have minimal effect on use, although the revenues raised could be directed to education or further study.

- **Education.** Respondents in an environmentally sensitive subsample report using significantly less fertilizer than the metro average. This may be explained by increased local awareness of off-site effects. This suggests that information campaigns aimed at increasing best management practices such as home lawn and garden soil tests may be effective in reducing over-application of chemicals.

- **Monitoring and Further Study.** The survey uncovered some unexpected similarities and differences between urban and rural groups, suggesting that both groups would support additional monitoring of urban and rural chemical use, and further study into the impacts of the chemicals on urban and rural residents. Any attempt to forge public policy on environmental issues will benefit from the existence of an apparent consensus on rural and urban use of agricultural chemicals.

USE OF LAWN CHEMICALS IN THE TWIN CITIES

INTRODUCTION

An expanse of green, healthy lawn is a valued part of the traditional American concept of a comfortable family home. With the development of inexpensive commercial fertilizers and rising household incomes in the post World War II era, the lawn care industry has grown into a $1.5 billion enterprise (Stevens, 1990). Concern for both human health risks and adverse environmental effects has grown as well. Health risks posed by use of lawn care pesticides have recently been examined by the U.S. General Accounting Office,[1] resulting in calls for tighter regulation of professional applicators. Recognition of the contribution to water quality problems from lawn care practices has had a similar effect.

In Minnesota, new regulations governing law care practices have been introduced at both the state and local levels of government. These have generally taken the form of state-level restrictions on pesticides and local-level fertilizer restrictions. It is helpful to place these efforts within the larger context of the evolution of environmental regulation. This process has occurred in three broad areas: (a) Regulations have evolved from a primary focus on acute (i.e. health) effects to a position that recognizes chronic (i.e. environmental) effects; (b) The scale of pollution has shifted from fixation on point sources to awareness of non-point sources; and, (c) The base of regulatory authority has shifted from being centralized to being decentralized.

Environmental regulations date back to the 1947 passage of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (Public Law 80-104). This law required that pesticides be registered by the Department of Agriculture (USDA). The registration process was designed to verify manufacturer's claims of effectiveness and ensure that the product label contained directions for use that were "adequate for the protection of the public." This early form of regulation was interpreted to be narrowly focused on acute effects, and data requirements were highly variable. Even so, the job was soon recognized to be too large for USDA.

In 1970, The President established the Environmental Protection Agency (EPA) and conferred upon it the duties of pesticide registration according to the requirements of FIFRA. In 1972 Congress amended FIFRA to require re-registration of all pesticides. New registrations required more data, and assurances that

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[1]A 1990 GAO report noted: "...the lawn pesticides industry continues to make prohibited claims that its products are safe or nontoxic." ... "EPA considers these claims false and misleading" (p. 3).

a pesticide would not cause "unreasonable adverse effects on the environment." This phase marks a shift towards recognition of potential chronic effects. The re-registration mandate created a large burden for EPA. Congress set, extended, and later removed deadlines for its completion. This process is still incomplete. The U.S. General Accounting Office (GAO), in a 1990 report noted: "EPA has yet to establish an effective program to determine whether pesticide manufacturers and distributors are, in fact, complying with FIFRA requirements" (p. 3).

Also in 1972, the Clean Water Act was amended (PL 92-500). This act was designed to curtail point-source surface water pollution and provide funding for municipal water treatment facilities. This law has been further amended (1977,1987) to add emphasis to non point-source pollution control.

Another trend is the shift in scale from centralized to decentralized regulation. Responding to the general paralysis at EPA induced by re-registration burdens and reduced funding, many states and localities have begun enacting their own regulations. In Minnesota there are many such examples. Professional pesticide applicators are regulated by the state Department of Agriculture. Applicators must be trained and licensed, and equipment is inspected periodically (Schmickle, 1991). Recently, some cities have also responded by regulating fertilizer applications. The city of St. Paul requires commercial applicators to post warnings after application. The cities of Bloomington, Roseville and Shoreview require licensing of commercial applicators (Minnesota Department of Agriculture, 1990). These and other localities have ordinances regulating application dates, restrictions of products (notably phosphorus fertilizers), or product verification.

Public policy has also developed in the direction of educational programs. Some localities have instituted programs to provide homeowners with additional information on the use of lawn care chemicals. The city of Eagan has a water quality management plan that provides lawn care education, financed by an assessment based on the runoff potential of residential, business and commercial property (Harvey, 1991).

In this way regulations at the state and local levels have added to or supplanted federal regulation. Even more restrictive measures have been proposed. In both Minnesota and Wisconsin, bills have been introduced in state legislature that would require homeowners applying lawn chemicals themselves to post their property. Crafting these new regulations requires more information than is currently available. The informational demands of regulations that attempt to address environmental effects of non-point source pollution problems through a decentralized administration are understandably large. Would-be regulators must understand complex and highly site-specific reactions to widely dispersed events, and work within a complex institutional framework of jurisdiction. This study attempts to contribute to this information by addressing the magnitude of

urban applications of lawn care chemicals and conditions that affect their demand.

In addition, this study examines practices within a specific region. To date, only aggregate statistics were available: EPA estimates that about 70 million pounds of pesticides (active ingredient) are applied annually in urban areas and that the rate is growing 5-8 percent per year (Stevens, 1990). This amounts to 8 percent of the total active ingredients applied in agriculture (GAO, 1990). In a 1990 Minnesota Department of Agriculture Task Force meeting, it was noted that records at the National Fertilizer Institute indicate that urban uses account for 4.5 percent of total nitrogen use (MDA Minutes, p. 8).

In response to the lack of reliable information, a survey was conducted during the summer of 1991 by researchers at the University of Minnesota. The survey was conducted in the Twin Cities (Seven County) metropolitan area (TCMA hereafter) of residents regarding their lawn care practices. The survey design and methodology were developed and implemented by the Minnesota Center for Survey Research. Questions were designed to allow estimation of: (a) The total quantities of selected active ingredients of lawn care chemicals that are applied by individuals and professional applicators; (b) The factors that seem to influence demand for lawn chemicals; and, (c) The potential for environmental degradation as a result of these practices.

Two lawn care surveys were conducted by telephone. The first was conducted from May 22 to June 25, 1991. Respondents were selected at random by the Minnesota Center for Survey Research from the population of all residents in the TCMA. The overall response rate was 81 percent and a total of 410 interviews were conducted. The second survey was designed to focus on a environmentally sensitive area (LMT hereafter). For this survey, 243 residents of a single census tract selected by virtue of its relatively large amount of shoreline on Lake Minnetonka were asked a similar set of questions, focusing slightly more on potential for (and the fate of) runoff. The overall response rate in the LMT was 75 percent.

This work, while preliminary, was designed to complement existing studies of the human health effects of exposure to lawn chemicals and to provide insights for public policy. Data analysis and preparation of this paper was done in consultation with representatives of the University of Minnesota (Departments of Horticulture, Forest Resources and Agricultural Engineering); Metropolitan Council; Freshwater Foundation; Gray Freshwater Biological Institute; Minnesota Extension Service; the Public Works Department of Ramsey County; and the cities of Roseville and Eagan. However, the authors assume full responsibility for the contents of this report.

ESTIMATION OF QUANTITIES

The first goal of the survey was to estimate total quantities of active ingredients of fertilizers and pesticides applied in the TCMA. The survey revealed that 72 percent of respondents applied fertilizer and/or weed killer to their lawns. It was assumed that respondents would be unable to provide detailed product analyses through direct questioning, so an indirect method was used. A series of questions was asked in order to determine (a) the area of respondent's property; (b) the percentage that was devoted to lawn; and (c) the percentage that was treated with lawn chemicals (fertilizers and weed killers, respectively). Multiplication yielded an estimate of the area to which chemicals were applied.

$$[AREA(ft^2)] \times [\%\ LAWN] \times [\%\ TREATED] = AREA\ TREATED\ (ft^2)$$

In the TCMA sample, the average property size was found to be just over 21,000 sq. ft. Accounting for buildings, sidewalks, driveways, etc., respondents indicated that about half their property was lawn (mean = 53 percent). The average fraction of lawn treated with fertilizer was 89 percent. The average fraction of lawn treated with weed killer was 61 percent. Taking the product, the average (over TCMA respondents) area treated with fertilizer was found to be 15,261 sq.ft. The average area treated with weed killer was 11,967 sq.ft. These numbers are averages over individual treated area estimates.

After reducing common lawn chemicals to their active ingredients, estimation of quantities proceeded on an initial assumption that individuals followed product label directions with regard to rates. This assumption was then relaxed to allow for both under- and over-application. This "sensitivity analysis" used a range of rate figures with recommended rates in the center, between the low and high rate figures. When multiplied by the area estimate, this yielded a range of estimates of the quantity used per application. Respondents were then asked a series of questions to calculate their total number of applications in 1990. We then calculated an annual gross quantity per household estimate according to the formula:

$$[APPLICATION] \times [NUMBER(Spring, Summer, Fall)] = ANNUAL\ QUANTITY$$

We did not, however, include quantities of fertilizers used on public parks, golf courses, cemeteries, and roadways, all of which would raise the total quantities we reported. Unfortunately, such estimates are unavailable at the present time.

FERTILIZERS

Lawn fertilizers typically contain nitrogen (N), phosphorus (P_2O_4), potassium (K_2O) and may also contain weed killer. We first calculated estimates of average quantities of nitrogen applied in 1990 using a range of alternative rates of application centered around the recommended rate of 1 lb. per 1,000 square feet (White, 1991; Decker and Decker, 1988; Snyder, 1985).

Of those who apply lawn chemicals, the average seasonal nitrogen application was 55 pounds per year in the TCMA. Of this group, 74 percent applied lawn chemicals themselves, and 26 percent hired a professional lawn service. Since 28 percent of the sample applied none at all, for the sample population as a whole, the average seasonal nitrogen application was 36 pounds per year. By multiplying the average seasonal nitrogen application for the sample population by the estimated number of lawns in the seven county area, the seasonal nitrogen application for the TCMA was estimated to be 25,529,295 lbs. or 12,765 tons (Table 1).[2]

TABLE 1: QUANTITIES OF NITROGEN USED AT VARIOUS RATE ASSUMPTIONS

RATE / GROUP	0.75 lb. N /1000 sq.ft.	1.0 lb. N /1000 sq.ft.	1.25 lb. N /1000 sq.ft.
USERS	41 lbs./yr.	55 lbs./yr.	68 lbs./yr.
POPULATION	27 lbs./yr.	36 lbs./yr.	44 lbs./yr.
TOTALS	**9,573 tons**	**12,765 tons**	**15,956 tons**

Source: TCMA Lawn Care Survey, 1991.

Note: "USERS" means the subset of respondents that use fertilizers or weed killers respectively.
"POPULATION" means all survey respondents.
Group averages reflect rounding error.
Totals are for the Seven County Metro Area.

[2]The total number of lawns was calculated from the 1990 Census of Population and Housing. The number of lawns figure was based on the total number of owner or renter occupied, 1-to-19 unit structures in the seven county area. A "housing unit" is defined by the census bureau as "a house, an apartment, a group of rooms, or a single room, occupied as a separate living quarters or, if vacant, intended for occupancy as a separate living quarters." It was assumed that single family homes (rented or owner occupied), duplexes, and structures of up to 19 housing units have a lawn of some size, and structures with more than 20 units do not.

These numbers are below the recommendations of some turf specialists. A wide variety of lawn care reference books contain recommendations that amount to about 5 lbs. of N per year, per 1,000 square feet (Sprague, 1982; Snyder, 1985; Decker and Decker, 1988). For example, a common recommendation calls for 1 lb. per 1,000 sq. ft. five times a year (217.8 lbs. per acre). If all fertilizer users in the survey applied nitrogen fertilizer (N) at this rate, the average quantity used per household would have been about 70 lbs. This is 27 percent higher than the estimated amount.

We next calculated quantity estimates for phosphorus (P_2O_4). Using a range of application rates centered at the average rate of 0.25 lb. per 1,000 square feet (White, 1991), and using survey information for area, percent treated, and number of applications yielded an estimate of 6,382,000 lbs. or about 3,191 tons of phosphorus used annually in the TCMA (Table 2).

TABLE 2: QUANTITIES OF PHOSPHORUS USED AT VARIOUS RATE ASSUMPTIONS

RATE / GROUP	.10 lb. /1000 sq.ft.	.25 lb. /1000 sq.ft.	.35 lb. /1000 sq.ft.
USERS	5 lbs./yr.	14 lbs./yr.	19 lbs./yr.
POPULATION	4 lbs./yr.	9 lbs./yr.	12 lbs./yr.
TOTALS	**1,274 tons**	**3,191 tons**	**4,468 tons**

Source: TCMA Lawn Care Survey, 1991.

Note: "USERS" means the subset of respondents that use fertilizers or weed killers respectively.
"POPULATION" means all survey respondents.
Group averages reflect rounding errors.
Totals are for the Seven County Metro Area.

There is reason to believe that phosphorus content of fertilizer may be more variable due in part to local restrictions. Some soil test data indicates that many residents need not apply any phosphorus at all. Even so, all fertilizer products formulated for lawns contain a minimum of 2 percent phosphorus, and the majority of products available in the TCMA contain at least 3 percent (Brasch, 1992). A calculation based on a 3 percent concentration should provide a conservative estimate. Three percent of a 20 lb. bag of fertilizer, applied over 5,000 sq. ft. (a representative rate) is roughly equivalent to 0.10 lb. active ingredients (AI) per 1,000 sq. ft. Estimates based on this are shown in the first column.

These total quantity estimates are useful to the extent that lawn care practices are standardized. Multiplication of average quantities by the population size assumes that all households in the population are similar. In mild support of this, we found that 78 percent are not planting or renovating any part of their lawn, a process that would require different fertilizer management practices. To further refine our estimates, nutrient applications from other sources might be considered. The survey found that 68 percent usually bag their lawn clippings, which if left on the lawn would equate to about 1 application of N at the rate of 1 lb. per 1,000 sq. ft. (Minnesota Department of Agriculture, 1990).

A more thorough estimate of total quantities would also include other uses of fertilizers and pesticides, such as on gardens and trees. But we found that 66 percent did not have gardens that they fertilized, and 67 percent did not have trees that they fertilized. Hence, these estimates seem reasonable for individual use. Of those respondents who do use lawn chemicals, and apply lawn chemicals themselves, 82 percent indicated that the annual quantities used were typical, whereas of those users who hire a professional service, 86 percent indicated that the annual quantities used were typical.

WEED KILLERS

A similar calculation was made with survey variables to estimate total quantities of herbicides applied. The results are more difficult to interpret, however, because while the active ingredients in fertilizers are the same, a multitude of chemicals exist for control of common weeds. The most common herbicide in use on residential lawns is 2,4-D (GAO, 1990)[3]. Another widely used herbicide is Dimethylamine Dicamba (White, 1991; Scott, 1991). Herbicides are often applied in mixture with insecticides. It was assumed that respondents would be unable to provide detailed analysis of the products they applied. For the purposes of this survey, we grouped all such products together and referred to them as "weed killer."

Weed killer may be applied alone or mixed with a fertilizer product. The survey provided information allowing estimation of total quantities of weed killer coming from both sources. To estimate quantities we again used the responses to the question about lawn area (excluding buildings, etc.) and multiplied this by the percentage of lawn treated. Multiplying this area by an

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[3]Common herbicides such as 2,4-D may pose health risks to humans and pets. A 1991 study found that dogs whose owners used a herbicide containing 2,4-D were up to twice as likely to develop lymphatic cancer ("Study Links Use of 2,4-D on lawn to Cancer in Dogs", Star Tribune. Sept.4, 1991)

application rate taken from a range centered at the recommended rate of 9.075 pints per acre[4] gives each individual's total application, which is then multiplied by the number of applications to yield the total annual quantity. This figure was then converted to pounds of active ingredients. At this step, we make the assumption that weed killer is an undifferentiated commodity and that the concentration is constant at 2 lbs. active ingredient (AI) per gallon.[5]

These calculations result in an estimated 193,101 lbs. of weed killer applied alone annually in the TCMA (Table 3). This excludes the weed killer that may be mixed with fertilizers.

TABLE 3: QUANTITIES OF WEED KILLERS USED ALONE AT VARIOUS RATE ASSUMPTIONS

RATE GROUP	1.5 lbs. A.I. / gallon	2.0 lbs. A.I. / gallon	2.5 lbs. A.I. / gallon
USERS	.77 lbs./yr.	1.02 lbs./yr.	1.28 lbs./yr.
POPULATION	.20 lbs./yr.	0.27 lbs./yr.	0.34 lbs./yr.
TOTALS	**144,730 lbs./yr.**	**193,101 lbs./yr.**	**241,218 lbs./yr.**

Source: TCMA Lawn Care Survey, 1991.

Note: "USERS" means the subset of respondents that use fertilizers or weed killers respectively.
"POPULATION" means all survey respondents.
Group averages reflect rounding error.
Totals are for the Seven County Metro Area.

To calculate quantities of weed killer applied in combination with fertilizer products, we used the same methodology, with rates taken from a range around 0.04 lb per

[4]This rate is the equivalent of one quart per 9600 square feet, the application rate of Ortho Weed B Gon, a common brand of 2,4-D used on residential lawns.

[5]This figure is representative of a wide range of weed killer formulations using both 2,4-D and other products (Weed Science Society of America, 1989).

thousand square feet[6]. Of those who use combination fertilizer and weed killer products, the average quantity of active ingredient of weed killer is 1.45 lbs./household/year. Including both users and non-users, the average quantity applied is 0.40 lbs./household/year. Extending this average annual application to the entire population of the TCMA, we estimated a total of 283,561 lbs. used annually (Table 4).

TABLE 4: QUANTITIES OF WEED KILLERS USED IN COMBINATION WITH FERTILIZER AT VARIOUS RATE ASSUMPTIONS

RATE / GROUP	0.02 lbs A.I. / 1000 sq ft.	0.04 lbs A.I. / 1000 sq ft.	0.06 lbs A.I. /1000 sq ft.
USERS	.73 lbs/yr	1.45 lbs/yr	2.17 lbs/yr
POPULATION	.20 lbs/yr	0.40 lbs/yr	0.60 lbs/yr
TOTALS	**143,475 lbs/yr**	**283,561 lbs/yr**	**430,426 lbs/yr**

Source: TCMA Lawn Care Survey

Note: "USERS" means the subset of respondents that use weed killers in combination with fertilizers.
"POPULATION" means all survey respondents.
Group averages reflect rounding error.
Totals are for the Seven County Metro Area.

Summing the quantities of weed killer applied alone and in combination with fertilizers (Tables 3 and 4) yields estimates of the total loadings of pesticides to area lawns. This figure is estimated to be 476,662 lbs./year at recommended rates, with a lower bound of 288,205 lbs./year and an upper bound of 671,644 lbs./year.

In contrast to our findings for fertilizers, the figure for weed killers indicates relatively high levels of application. One way in which to think about these levels is to compare them to the levels of herbicide used on farms in Minnesota. An estimated 30,199,000 lbs. of active ingredients of herbicides are used in Minnesota annually (Gianessi and Puffer, 1990). Thus, combining weed killer used alone and in combination with fertilizers on urban lawns, we estimate that the total is about 1.6 percent of the total quantity of herbicides used in Minnesota agriculture. The estimate of total area of lawns in the TCMA is 251,329 acres, just less than 1 percent of the 30 million acres

[6]This figure is representative of this class of products. They tend to be about 1 percent (by weight) herbicide, and a 20 pound bag covers about 5,000 square feet. This is the equivalent of 0.04 pounds per 1,000 square feet.

in agriculture and only 1.3 percent of the 19 million acres in cropland in Minnesota (U.S. Statistical Abstract, 1991). On a per acre basis, this indicates that use levels in urban areas are about the same as on agricultural lands.

Alternatively, we could compare usage of particular products. An estimated 1,262,501 pounds of 2,4-D and 821,564 pounds of diacamba are used in Minnesota agriculture annually (Gianessi and Puffer, 1990). It is suggested that 2,4-D is the most widely used herbicide in urban areas. If we assume that 75 percent of the estimated total quantity of weed killer is 2,4-D, the quantity used in the metropolitan setting is about 212,670 lbs., or 17 percent of the total quantity of 2,4-D used in agriculture. Recall that the area in lawns in the TCMA is 1.3 percent of cropland acres. We conclude that aggregate usage rates are lower in the urban setting than in agriculture, but usage rates of individual products may be higher due to the limited range of products distributed for use on lawns.

CONSUMER DEMAND FOR LAWN CARE

The second objective of the survey was to estimate the factors that influence households demands for lawn chemicals and the price responsiveness of those demands. The survey instrument included a hypothetical question of the form "if the total cost for fertilizer and weed killer had been X dollars in 1990, do you think you would have purchased the same services?". For this question, the number X was a multiple (10-200 percent) of the amount the respondent reported spending. A detailed analysis of this data will be the subject of forthcoming reports. However, the policy section of this paper will benefit greatly from discussion of some basic results.

Interestingly, when faced with the above question, 50 percent of the respondents who use lawn chemicals said "yes." That is, about half would pay (10-200 percent) more for the same services. This data allowed us to calculate the price "elasticity" of demand, or the degree to which consumers would reduce their purchases of fertilizer and weed killers as prices rose. For those respondents who would not pay the increased price, we asked a series of follow up questions designed to estimate what products or services would be eliminated and how much would be spent on the reduced program.

This method clearly had a much higher sampling error, as "don't know" responses had to be eliminated, but the results are nonetheless valuable for our purposes. For the sample population group of "do-it-yourselfers," we found 14 respondents to have price "elasticities" greater than one in absolute value, 15 respondents to have unitary price elasticities, and 95 respondents to have price elasticities of zero.

From these results, it is possible to conclude that demands for lawn chemicals are not very price "elastic," i.e., that even as prices increase, consumers continue to demand and apply about the same amount. Other factors that might influence this consumer behavior include neighborhood peer pressure, income, and other descriptors such as number of children, etc. Investigating these possibilities, we found that

- 36 percent say having a nice looking lawn is very important
- 93 percent say having a nice looking lawn is either very important or somewhat important
- 36 percent say that their neighbors think it is very important to have well-groomed lawns
- 90 percent say that their neighbors think having a nice looking lawn is either very important or somewhat important

We could not prove or disprove statements about the effects of neighborhood, but the possibility that "Keeping up with the Jones" is an important motivating factor seems strong.[7]

ATTITUDES AND POTENTIAL ENVIRONMENTAL EFFECTS

The concern for harmful effects on the environment as a result of use of fertilizers and pesticides is an increasingly important agricultural policy issue.[8] Much has been made of the degree of polarization in that debate. Agribusiness and environmental interest groups, respectively, have largely subscribed to two opposing views about the status quo levels of

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[7]The role of the lawn in American culture is explored in an article by Lowen (1991). In it, she delineates several factors, including coercion by one's neighbors, that explain the importance of a well-manicured lawn.

[8]We also asked a number of questions about health risks. These are not the focus of this paper and are included only as descriptive:

- 17 percent feel that lawn chemicals pose a high health risk to adults and children when used according to label directions.
- 45 percent feel that lawn chemicals pose a moderate health risk to adults and children when used according to label directions.
- 38 percent feel that lawn chemicals pose a low health risk to adults and children when used according to label directions.

intensity of chemical use in agriculture. At one end of the debate are those who contend that the chemicals used are safe, and are generally properly applied. At the other end of the spectrum are those who contend that they are unsafe, and often improperly applied. Our objective was not to answer these questions, so much as to provide data useful to a more informed discussion. However, we did pose several questions designed to determine whether differences in opinion over these issues reflected a "rural-urban" split.

To test for such a split in opinion between rural and urban communities, we included in our survey two questions that had previously been asked in a survey of Minnesota farmers conducted in 1990.[9] These revealed very little difference in attitudes of the two groups toward chemicals (Tables 5 and 6).

TABLE 5: COMPARISON OF ATTITUDES FROM TWO SURVEYS

"The dangers of groundwater pollution from nitrogen fertilizers have been greatly exaggerated."	MN Farmers Survey	Metro Lawncare Survey
Strongly Agree	6	4
Agree	27	25
Disagree	34	40
Strongly Disagree	17	11
Don't Know	16	20

Source: TCMA Lawn Care Survey and Minnesota Farmer Survey, 1991.

TABLE 6: COMPARISON OF ATTITUDES FROM TWO SURVEYS

"Not enough is being done to limit the harmful effects of chemicals on farms."	MN Farmers Survey	Metro Lawncare Survey
Strongly Agree	20	21
Agree	37	47
Disagree	24	16
Strongly Disagree	3	2
Don't Know	16	14

Source: TCMA Lawn Care Survey and Minnesota Farmer Survey, 1991.

[9]The Minnesota Center for Survey Research conducted this survey for the Land Stewardship Project at the University of Minnesota. The survey instrument was comprised of 1,016 mailed questionnaires.

The Farmers Survey indicated that some political interests had misrepresented the attitudes of the farm community by making chemical use a "sacred cow". Farmers were, in fact, sensitive to environmental problems and willing to reevaluate their practices. The response to this question in our survey indicated that urban and rural communities are surprisingly close in attitude toward this issue. It is clear that both urban and rural communities share similar concerns.

We also asked a similar question in our survey of urban residents about the differences between rural and urban environment (Table 7). Comparing responses to the two questions, we can infer that there is very little difference in attitude toward urban and agricultural environmental regulation. This fact could be the foundation on which to build a political coalition to uniform regulations affected chemical use in both areas. In both groups, a majority (57 percent of farms and 68 percent of urbanites) strongly agree or agree that not enough is being done to limit the harmful effects of chemicals on farms, and a clear majority (74 percent) of urbanites strongly agree or agree that not enough is being done to limit harmful effects of chemicals in urban areas.

TABLE 7: METRO RESIDENTS ATTITUDES TOWARD URBAN AND RURAL PESTICIDE REGULATIONS.

"Not enough is being done to limit the harmful effects of chemicals...	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know
..on farms."	21	47	16	2	14
..in urban areas."	22	52	16	1	9

Source: TCMA Lawn Care Survey, 1991.

LMT SURVEY RESULTS

After completing the metro area survey, we conducted another survey of residents in a limited census tract (LMT) selected by virtue of a high ratio of shoreline (on Lake Minnetonka) to total area. The instrument used in this survey was essentially the same, but designed to ask questions more related to environmental effects. Sample size was 243 households.

Lake Minnetonka is a large body of water southwest of the city of Minneapolis, within the TCMA. The lake is actually a series of interconnected shallow bays, and hence has a large amount of shoreline. Most of the shoreline has been developed for residential use. The lake has a history of water quality problems.[10] When respondents were asked how they would rate water quality, 78 percent said either "fair" or "poor" (Table 8).

TABLE 8: OPINION OF WATER QUALITY IN LAKE MINNETONKA

"In your opinion, how would you rate the water quality in lake Minnetonka?"	
Excellent	3%
Good	20%
Fair	43%
Poor	35%

Source: LMT Lawncare Survey, 1991.

TABLE 9: WATER QUALITY PROBLEMS IN LAKE MINNETONKA

	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know
"Milfoil ... is a problem in Lake Minnetonka"	70	27	2	0	1
"Algae ... is a problem in Lake Minnetonka"	34	42	17	2	5

Source: LMT Lawncare Survey, 1991.

Comparing quantities applied in the LMT area with those used in the TCMA, among the group that applied fertilizer, the average seasonal nitrogen application was 55 pounds per year in the TCMA and 30 pounds per year in the LMT area. For the population as a whole, including the 48 percent of those in the LMT area that applied no fertilizer at all, the average seasonal nitrogen

[10]Seven municipalities discharged waste water into lower Lake Minnetonka through the late 1970s. The last was diverted in July 1986 and water transparency has markedly increased (MPCA, 1990, p. 26).

application was 36 pounds per year in the TCMA and 12 pounds per year in the LMT area. This result indicates that LMT residents tend to use much less fertilizer than the general TCMA public.

TABLE 10: COMPARISON OF LMT AND TCMA

	TCMA	LMT
Fertilizer (Nitrogen) - Users	55 lbs./year	30 lbs./year
Fertilizer (N) - population	36 lbs./year	12 lbs./year
Weed Killer applied alone - Users	1.02 lbs./year	1.72 lbs./year
Weed Killer applied alone - population	0.27 lbs./year	0.28 lbs./year
Weed Killer applied in combination - Users	1.28 lbs./year	0.62 lbs./year
Weed Killer applied in combination - population	0.40 lbs./year	0.12 lbs./year
Fertilized Area	15,261 square feet	14,623 square feet
Average Household Income Group	$45,000	$45,000

Source: TCMA and LMT Lawncare Survey, 1991.

Table 10 summarizes the comparison of fertilizer use between TCMA and LMT, as well as some useful descriptors. The difference in fertilizer use is reflected in estimates of weed killer used in combination. Interestingly, there were no significant differences in either fertilized area or income. These data cannot explain the difference in usage. This may be attributable to recent efforts to better inform property owners about the effects on Lake Minnetonka resulting from lawn care practices, such as those conducted by the Gray Freshwater Biological Institute.

The difference between average quantities of fertilizer applied in the LMT and TCMA could have important implications. Investigating further, we found that the difference is due to two factors: (1) the do-it-yourselfers in the LMT seem to apply fertilizer less often than the do-it-yourselfers in the TCMA; and (2) overall a smaller percentage of respondents in the LMT survey apply fertilizer (either themselves or commercially) than in the TCMA.

TABLE 11: AVERAGE APPLICATIONS: TCMA VERSUS LMT

Respondents	Average Number of Fertilizer Applications	
	Do-It-Yourselfers	Commercial Applications
TCMA	2.79	3.83
LMT	1.97	4.05

Source: TCMA and LMT Lawncare Survey, 1991.

TABLE 12: PERCENTAGE OF RESPONDENTS WHO USE FERTILIZER AND/OR WEED KILLER: TCMA VERSUS LMT

Respondents	Percent Using Fertilizer and/or Weed Killer
TCMA	72
LMT	52

Source: TCMA and LMT Lawncare Survey, 1991.

Considering first the groups in each survey that hire commercial applicators, we found that the number of applications is about the same: 3.83 applications per year for the TCMA and 4.05 for the LMT (Table 11). This makes sense because we would expect commercial applicators to be offering the same basic package of service to LMT and TCMA residents. Comparing the groups who apply fertilizer themselves, we found that LMT residents, on average, apply almost one application less than the TCMA average. LMT residents average 1.97 applications per year while TCMA residents average 2.79 applications per year (Table 11).

A larger difference was recorded in the percentage of respondents who use fertilizer (either commercially applied or self-applied). Only 52 percent of respondents within the LMT apply fertilizer as opposed to 72 percent applying fertilizer in the TCMA (Table 12).

This reduction in quantities of fertilizer does not extend to weed killers. For the groups of users, the average seasonal weed killer application (combining sources) was 2.30 pounds per year in the TCMA and 2.33 pounds in the LMT area. Including all residents, the average quantity of weed killer applied is 0.54 lbs./household/year in the TCMA. In the LMT area we found it to be 0.40 lbs./household/year.

In addition to the quantity estimates, we asked several questions to gauge the surface runoff potential from respondent's lawns in the LMT area:

- 39 percent have a steeply sloped portion of lawn, averaging about 10 percent of total lawn area.
- 74 percent have a portion of lawn with some slope,
- 39 percent water at least some part of their lawn, for an average time of almost an hour, average frequency of between once and twice a week.
- 16 percent had trees in their lawn which they fertilized.

We then asked questions to evaluate the fate of runoff from lawns:

- 41 percent indicate that runoff from their lawns drains mainly into the street (and hence storm sewer system).
- 7 percent responded that their lawn drained primarily into their neighbor's lawn.
- 30 percent own lake frontage and 27 percent indicate that runoff from their lawns drains mainly into Lake Minnetonka, while 5 percent said runoff went into some other body of water.
- Of those that own lake frontage, 42 percent had taken measures to control aquatic weeds during the year.

In order to make a connection between applications of lawn care chemicals and water quality in the lake, a number of intermediate linkages need to be investigated which are beyond the scope of this survey. For example, much recent concern over water quality in Lake Minnetonka has focused on milfoil, an exotic weed that reproduces at a very high rate. However, the presence of milfoil may be less an indicator of poor water quality than it is an indicator of other management problems. Algae, in contrast, seems to respond to nutrient rich runoff, with phosphorus more often the limiting nutrient determining the level of algae growth. Phosphorus tends to adhere to soil particles, and hence phosphorus pollution is generally reduced by practices that reduce soil erosion. Turf grass, with its high plant density and characteristic root structure, is an excellent inhibitor of runoff. Hence it is at least possible that fertilizing lawns may improve water quality in some areas.

POLICY IMPLICATIONS

The results of this survey are intended as an initial step toward determining the levels of urban lawn chemical use and consumer attitudes toward this use. While they should be interpreted with care, and are only a first step, they do suggest several implications for policy.

First, average levels of lawn fertilizer used in the Twin Cities appear to fall below the levels recommended by some turf specialists. This result does not mean that runoff of nitrogen or phosphorus into water sources may not be occurring at excessive rates in particular areas, but it does imply that the overall levels of application are not in excess of those recommended.

Secondly, and in contrast, our survey results suggest that application rates of pesticides are similar to average levels used in agriculture. Since it is weed killer that appears to pose the most important potential health effects, current levels of use in urban areas, where food and fiber are not at stake, may raise questions of priorities.

Third, the survey indicates that the quantities of lawn chemicals purchased are not strongly responsive to changes in their price. This suggests that public policies designed to raise these prices through taxes or fees will not substantially reduce consumer use (although they will raise revenues). Hence a "pollution tax" applied to lawn chemicals can produce a stream of revenue which may be applied to education or new technologies, but it will not reduce use unless it is very large.

Fourth, attitudes toward the potentially adverse impacts of lawn chemicals in the metro area appear very similar to the concerns of farmers revealed in an earlier survey. Both urban and rural residents appear similarly concerned about the need for limitations on the harmful effects of agricultural chemicals. No rural/urban split on the issue is apparent.

Fifth, results of a subsample of respondents living on or near Lake Minnetonka indicate that fertilizer applications are much lower there than in the metro area as a whole, suggesting sensitivity to their possible impacts on water quality. However, no corresponding in use of weed killer is apparent.

RECOMMENDATIONS

- **Regulation.** While we are unable, as a result of this work, to show a need for strict regulation, we are able to show that "pollution taxes" would likely have minimal effect on use, although the revenues raised could be directed to education or further study.

- **Education.** Respondents in an environmentally sensitive sub-sample report using significantly less fertilizer than the metro average. This may be explained by increased local awareness of off-site effects. This suggests that information campaigns aimed at increasing best management practices such as home lawn and garden soil tests may be effective in reducing over-application of chemicals.

- **Monitoring and Further Study.** The survey uncovered some unexpected similarities and differences between urban and rural groups, suggesting that both groups would support additional monitoring of urban and rural chemical use, and further study into the impacts of the chemicals on urban and rural residents. Any attempt to forge public policy on environmental issues will benefit from the existence of an apparent consensus on rural and urban use of agricultural chemicals.

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APPENDIX A

5-22-91

TWIN CITIES AREA LAWN CARE SURVEY

A. Hello, my name is _____. I'm a student calling from the University of Minnesota.

B. We're doing a study about lawn care for the university's Department of Agricultural and Applied Economics.

C. 1. First, do you own your residence?
1. Yes 2. No (IF NO, TERMINATE**)

2. (IF YES, OWN) Have you lived at your present address for at least one year?
1. Yes 2. No (IF NO, TERMINATE**)

3. (IF YES) Do you have a lawn?
1. Yes 2. No (IF NO, TERMINATE**)

D. I need to talk to the person in your household who makes the most decisions about lawn care. May I please speak to that person?

(IF RIGHT PERSON IS ON THE LINE, GO TO PARAGRAPH E.)

(IF RIGHT PERSON IS NOT ON THE LINE, ASK TO SPEAK TO THAT PERSON. WHEN HE/SHE IS ON THE LINE, REPEAT PARAGRAPHS A AND B, AND THEN GO TO PARAGRAPH E.)

(IF RIGHT PERSON IS NOT AVAILABLE) When would be the best time to speak with that person?
SPECIFIC TIME AND DATE: Time: _____ Date: _____

WHAT IS HIS/HER FIRST NAME?_____

E. Your answers will be combined with those from a lot of other people, so you won't be able to be identified in any way. If there are questions you don't care to answer, we'll skip over them. Okay, we'll begin.

(INTERVIEWERS; "HOUSEHOLD" MEANS WHATEVER THE RESPONDENT THINKS IT MEANS.)

(DO NOT PROBE "DON'T KNOW" RESPONSES.)

****(WHAT TO SAY WHEN TERMINATING IN INTRO:** "I'm sorry. I'm afraid you're not eligible for our study. Thanks for your time."

Q1. Is your property larger than one-half acre?

1. Yes (GO TO Q1A)
2. No (GO TO Q1B)
3. DK (GO TO Q1B)
4. RA (GO TO Q1B)

Q1A. (IF YES) About how many acres is your property?

_ _._ _ ACRES

2. DK
3. RA

Q1B. (IF NO) What are the width and depth of your property?
TYPE UNITS OF MEASUREMENT WITH NUMBERS

2. DK
3. RA

Q2. How accurate do you think your estimate of property size is... very accurate, accurate, not very accurate or not at all accurate?

1. Very accurate
2. Accurate
3. Not very accurate
4. Not at all accurate
5. DK
6. RA

CK1. INTERVIEWER: DID RESPONDENT

1. Check records
2. Give estimate
3. Make a wild guess

Q3. What percent of your property is lawn? Exclude the area taken up by your home, other buildings, driveway, vegetable and flower gardens, woods, and so forth.

_ _ _ % LAWN

2. DK
3. RA

Q4. Are you in the process of planting or renovating any part of the lawn on your property?

1. Yes
2. No
3. DK
4. RA

Q5. Last year, when your lawn was mowed, were the the clippings usually bagged?

1. Yes
2. No
3. DK
4. RA

Q6. Do you have a garden that you fertilized in 1990?

1. Yes
2. No
3. DK
4. RA

Q7. How many trees in your lawn did you fertilize in 1990?

_ _ TREES

2. DK
3. RA

Now I have some questions about lawn fertilizers and weed killers.

Q8. In 1990, did your lawn receive any type of fertilizer or weed killer application?

1. Yes
2. No (GO TO Q31)
3. DK (GO TO Q31)
4. RA (GO TO Q31)

Q9. Who applied that fertilizer or weed killer to your lawn last year... was it a commercial applicator, you or someone else in your household, both a commercial applicator and you or other?

1. Commercial applicator (GO TO Q23)
2. You or someone else in the household
3. Both commercial and you
4. Other
5. DK
6. RA

Q10. Did you use a special organic mixture or did you use a standard fertilizer?

1. Special organic mixture
2. Standard fertilizer
3. DK
4. RA

Q11. What percent of your lawn did you treat with fertilizer last year?

_ _ _ %

2. DK
3. RA

Q12. What percent of your lawn did you treat with weed killer, including any spot treatments, last year?

_ _ _ %

2. DK
3. RA

Q13. Thinking back to <u>last spring</u>, did you apply any fertilizer or weed killer to your lawn?

1. Yes
2. No (GO TO Q14)
3. DK (GO TO Q14)
4. RA (GO TO Q14)

Q13A. How many times did you apply a combination of fertilizer and weed killer to your lawn last spring?

_ _ TIMES

2. DK
3. RA

Q13B. How many times did you apply fertilizer to your lawn last spring?

_ _ TIMES

2. DK
3. RA

Q13C. How many times did you apply weed killer to your lawn last spring?

_ _ TIMES

2. DK
3. RA

Q14. Now thinking back to <u>last summer</u>, did you apply any fertilizer or weed killer to your lawn?

1. Yes
2. No (GO TO Q15)
3. DK (GO TO Q15)
4. RA (GO TO Q15)

Q14A. How many times did you apply a combination of fertilizer and weed killer to your lawn last summer?

_ _ TIMES

2. DK
3. RA

Q14B. How many times did you apply fertilizer to your lawn last summer?

_ _ TIMES

2. DK
3. RA

Q14C. How many times did you apply weed killer to your lawn last summer?

_ _ TIMES

2. DK
3. RA

Q15. And, then for <u>last fall</u>, did you apply any fertilizer or weed killer to your lawn?

1. Yes
2. No (GO TO Q16)
3. DK (GO TO Q16)
4. RA (GO TO Q16)

Q15A. How many times did you apply a combination of fertilizer and weed killer to your lawn last fall?

_ _ TIMES

2. DK
3. RA

Q15B. How many times did you apply fertilizer to your lawn last fall?

_ _ TIMES

2. DK
3. RA

Q15C. How many times did you apply weed killer to your lawn last fall?

_ _ TIMES

2. DK
3. RA

Q16. And, is it accurate that you applied a combination of fertilizer and weed killer to your lawn a total of X times last year?

1. Yes
2. No (GO TO Q16A)
3. DK
4. RA

Q16A. How many times in total did you apply a combination of fertilizer and weed killer to your lawn last year?

_ _ TIMES

Q17. So, is it accurate that you fertilized your lawn a total of X times last year?

1. Yes
2. No (GO TO Q17A)
3. DK
4. RA

Q17A. How many times in total did you apply just fertilizer to your lawn last year?

_ _ TIMES

Q18. Is it also accurate that you applied weed killer to your lawn a total of X times last year?

1. Yes
2. No (GO TO Q18A)
3. DK
4. RA

Q18A. How many times in total did you apply just weed killer to your lawn last year?

_ _ TIMES

Q19. Was the number of times you applied fertilizer and weed killer to your lawn last year typical of how you've been caring for your lawn?

1. Yes
2. No (DESCRIBE)
3. DK
4. RA

Q20. Was the amount you paid last year for lawn fertilizer and weed killer above or below $50?

1. Above $50 (GO TO Q20A)
2. Below $50 (GO TO Q20B)
3. DK (GO TO Q23)
4. RA (GO TO Q23)

Q20A. (IF ABOVE) I'm going to mention several price categories. When I come to the category that describes the amount you paid last year for lawn fertilizer and weed killer, please stop me.

1. 51 to 60
2. 61 to 70
3. 71 to 80
4. 81 to 90
5. 91 to 100
6. More than 100
7. DK (GO TO Q23)
8. RA (GO TO Q23)

Q20B. (IF BELOW) I'm going to mention several price categories. When I come to the category that describes the amount you paid last year for lawn fertilizer and weed killer, please stop me.

1. 10 or less
2. 11 to 20
3. 21 to 30
4. 31 to 40
5. 41 to 50
6. DK (GO TO Q23)
7. RA (GO TO Q23)

Q21. If the total cost had been X dollars for the fertilizer and weed killer you used in 1990, do you think you would have done the same thing?

1. Yes (GO TO Q23)
2. No
3. DK (GO TO Q23)
4. RA (GO TO Q23)

Q22. What would you have done differently then? (DO NOT READ LIST)

1. Reduce number of applications (GO TO Q22A)
2. Reduce area of lawn treated (GO TO Q22B)
3. Reduce both (GO TO Q22A and Q22B)
4. Other (SPECIFY) (GO TO Q22C)
5. DK (GO TO Q23)
6. RA (GO TO Q23)

Q22A. So how many times would you have applied fertilizer and weed killer then? (GO TO Q22C)

_ _ TIMES

2. DK
3. RA

Q22B. So what percent of your lawn would you have fertilized and treated with weed killer then? (GO TO Q22C)

_ _ %

2. DK
3. RA

Q22C. (FOR EVERYONE WHO ANSWERS Q22, UNLESS DK/RA)
How much would you expect to spend on this revised plan?

_ _ _.00 DOLLARS

2. DK
3. RA

(ASK Q23- ONLY IF Q9=1 or 3)

Q23. Which lawn care company did you hire in 1990? (DO NOT READ LIST)

1. Barefoot Grass (GO TO Q23A)
2. Chemlawn (GO TO Q23A)
3. Ever-Green (GO TO Q23A)
4. Green Stuff (GO TO Q23A)
5. Other (GO TO Q24A)
6. DK (GO TO Q24A)
7. RA (GO TO Q24A)

Q23A. (IF Q23=1,2,3 or 4) What was the name of the package of services you purchased from your lawn care company in 1990? (GO TO Q25)

2. DK (GO TO Q24A)
3. RA (GO TO Q24A)

Q24. Which of the following services did your lawn care company provide for you last year? (READ LIST)

		Yes	No	DK	RA
a.	Fertilized your lawn	1	2	3	4
b.	Weed control for your lawn	1	2	3	4
c.	Fertilized your trees	1	2	3	4
d.	Trimmed shrubs	1	2	3	4
e.	Mowed your lawn	1	2	3	4
f.	Plowed snow	1	2	3	4

Q25. (IF Q24A=YES) Was your lawn fertilized with a special organic mixture or with a standard fertilizer?

1. Special organic mixture
2. Standard fertilizer
3. DK
4. RA

Q26. How many applications of fertilizer and/or weed killer did your lawn care company make to your lawn last year?

_ _ APPLICATIONS

2. DK
3. RA

Q27. Was last year's lawn care service typical of the care your lawn has been receiving?

1. Yes
2. No (EXPLAIN)
3. DK
4. RA

Q28. How much did you spend on these fertilizer and weed killer services during all of 1990? (READ LIST)

1. $50 or less
2. $51 to 100
3. $101 to 150
4. $151 to 200
5. $201 to $250
6. $251 to $300
7. $301 to $350
8. $351 to $400
9. More than $400
10. DK (GO TO Q31)
11. RA (GO TO Q31)

Q29. If the total cost for fertilizer and weed killer had been X dollars in 1990, do you think you would have purchased the same services?

1. Yes (GO TO Q31)
2. No
3. DK (GO TO Q31)
4. RA (GO TO Q31)

Q30. What would you have done differently then? (DO NOT READ LIST)

1.	Pay for fewer treatments	(GO TO Q30A)
2.	Reduce area for treatments	(GO TO Q30B)
3.	I'd do it myself	(GO TO Q30C)
4.	Both 1 and 2	(GO TO Q30A and Q30B)
5.	Both 1 and 3	(GO TO Q30A and Q30C)
6.	Both 2 and 3	(GO TO Q30B and Q30C)
7.	All 3	(GO TO Q30A, Q30B and Q30C)
8.	Other (SPECIFY)	(GO TO Q30D)
9.	DK (GO TO Q31)	
10.	RA (GO TO Q31)	

Q30A. How many fertilizer and weed killer applications would you hire the lawn care company to make?

_ _ APPLICATIONS

2. DK
3. RA

Q30B. What percent of your lawn would you have the lawn care company fertilize and treat with weed killer?

_ _ %

2. DK
3. RA

Q30C. What percent of your lawn would you fertilize and treat with weed killer? (GO TO Q30C1)

_ _ _ %

2. DK
3. RA

Q30C1. How many times would you fertilize and apply weed killer to your lawn?

_ _ TIMES

2. DK
3. RA

Q30D. About how much would you expect to spend on this revised program?

_ _ _.00 DOLLARS

2. DK
3. RA

Now I have a few questions about other issues.

Q31. How important is having a nice-looking lawn to you... would you say it's very important, somewhat important, not very important or not at all important to you?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
5. DK
6. RA

Q32. How important do you think it is to your neighbors to have well groomed lawns... would you say it's very important, somewhat important, not very important or not at all important to them?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
5. DK
6. RA

Q33. How great a health risk do you believe home lawn chemicals--both fertilizers and weed killers--are to adults and children, if label directions are followed? Would you say there is a high health risk, moderate health risk, or low health risk?

1. High health risk
2. Moderate health risk
3. Low health risk
4. DK
5. RA

Please tell me if you strongly agree, agree, disagree or strongly disagree with the following statements. (READ LIST.)

	SA	A	D	SD	DK	RA
Q34A. The dangers of groundwater pollution from nitrogen fertilizers have been greatly exaggerated.	1	2	3	4	5	6

Q34B. Not enough is being done to limit the harmful effects of chemicals <u>on farms</u>. 1 2 3 4 5 6

Q34C. Not enough is being done to limit the harmful effects of chemicals <u>in urban areas</u>. 1 2 3 4 5 6

Before ending this interview, I have a few remaining background questions.

Q35. What is your zip code?

_ _ _ _ _

2. DK
3. RA

Q36. Was your total household income in 1990 above or below $25,000?

1. Above (GO TO Q36A)
2. Below (GO TO Q36B)
3. DK (GO TO Q37)
4. RA (GO TO Q37)

Q36A. (IF ABOVE) I am going to mention several income categories. When I come to the category that describes your total household income before taxes in 1990, please stop me.

1. 25 to 30,000
2. 30 to 35,000
3. 35 to 40,000
4. 40 to 50,000
5. 50 to 60,000
6. 60 to 70,000
7. 70,000 or more
8. DK
9. RA

Q36B. (IF BELOW) I am going to mention several income categories. When I come to the category that describes your total household income before taxes in 1990, please stop me.

1. Under 5,000
2. 5 to 10,000
3. 10 to 15,000
4. 15 to 20,000
5. 20 to 25,000
6. DK
7. RA

Q37. How many people are living in your household now, including yourself?

_ _ PEOPLE

2. DK
3. RA

Q37A. (IF MORE THAN ONE) How many of these people are under 18?

_ _ PEOPLE UNDER 18 (IF NONE, GO TO Q38)

2. DK
3. RA

Q37B. (IF ONE OR MORE) How many of these are under 6?

_ _ PEOPLE UNDER 6

2. DK
3. RA

(ASK ONLY IF UNSURE)
Q38. Respondent is

1. Male
2. Female
3. DK

Thank you for answering these questions. I appreciate your time.

APPENDIX B

8-13-91

TWIN CITIES AREA LAWN CARE SURVEY
HOT SPOT VERSION

A. Hello, my name is _____. I'm a student calling from the University of Minnesota.

B. We're doing a study about how people who live near lakes care for their lawns. The study is for the university's Department of Agricultural and Applied Economics.

C. 1. First, do you own your residence?
1. Yes 2. No (IF NO, TERMINATE**)

2. (IF YES, OWN) Have you lived at your present address for at least one year?
1. Yes 2. No (IF NO, TERMINATE**)

3. (IF YES) Do you have a lawn?
1. Yes 2. No (IF NO, TERMINATE**)

D. I need to talk to the person in your household who makes the most decisions about lawn care. May I please speak to that person?

(IF RIGHT PERSON IS ON THE LINE, GO TO PARAGRAPH E.)

(IF RIGHT PERSON IS NOT ON THE LINE, ASK TO SPEAK TO THAT PERSON. WHEN HE/SHE IS ON THE LINE, <u>REPEAT PARAGRAPHS A AND B</u>, AND THEN GO TO PARAGRAPH E.)

(IF RIGHT PERSON IS NOT AVAILABLE) When would be the best time to speak with that person?
SPECIFIC TIME AND DATE: Time: _____ Date: _____

WHAT IS HIS/HER FIRST NAME?_____

E. Your answers will be combined with those from a lot of other people, so you won't be able to be identified in any way. If there are questions you don't care to answer, we'll skip over them. Okay, we'll begin.

(INTERVIEWERS; "HOUSEHOLD" MEANS WHATEVER THE RESPONDENT THINKS IT MEANS.)

(DO NOT PROBE "DON'T KNOW" RESPONSES.)

****(WHAT TO SAY WHEN TERMINATING IN INTRO: "I'm sorry. I'm afraid you're not eligible for our study. Thanks for your time."**

Q1. Is your property larger than one-half acre?

1. Yes (GO TO Q1A)
2. No (GO TO Q1B)
3. DK (GO TO Q1B)
4. RA (GO TO Q1B)

Q1A. (IF YES) About how many acres is your property?

_ _·_ _ ACRES

2. DK
3. RA

Q1B. (IF NO) What are the width and depth of your property?
TYPE UNITS OF MEASUREMENT WITH NUMBERS

2. DK
3. RA

Q2. How accurate do you think your estimate of property size is... very accurate, accurate, not very accurate or not at all accurate?

1. Very accurate
2. Accurate
3. Not very accurate
4. Not at all accurate
5. DK
6. RA

CK1. INTERVIEWER: DID RESPONDENT

1. Check records
2. Give estimate
3. Make a wild guess

Q3. Do you own any lake frontage? (NOTE: answer to Q3 determines whether R gets Q16)

1. Yes
2. No
3. DK
4. RA

Q4. What percent of your property is lawn? Exclude the area taken up by your home, other buildings, driveway, vegetable and flower gardens, woods, and so forth.

_ _ _ % LAWN

2. DK
3. RA

Q5. What percent of your lawn would you say is fairly level?

_ _ _ % (IF Q5=100%, SKIP TO Q8)

Q6. Does any part of your lawn have a steep slope, steep enough that it's difficult to mow?

1. Yes
2. No (SKIP TO Q7)

Q6a. What percent of your lawn would you say has a steep slope?

_ _ _ %

Q7. Does any part of your lawn have some slope, that is, is neither fairly level nor steeply sloped?

1. Yes
2. No (SKIP TO Q8)

Q7a. What percent of your lawn would you say has some slope?

_ _ _ %

Q8. During a storm, where does most of the runoff from your lawn drain? (READ LIST)

1. Into the street
2. Into my neighbor's lawn
3. Into Lake Minnetonka
4. Into another body of water
5. Other --> Please specify:
6. DK
7. RA

Q9. Do you water any of your lawn?

1. Yes
2. No (SKIP TO Q13)

Q10. How much of your lawn do you water...all of it, about 75%, about 50%, about 25% or less than 25%?

1. All of it
2. About 75%
3. About 50%
4. About 25%
5. Less than 25%

Q11. On average, how often do you water your yard during the growing season? Take into account any sprinkling guidelines in your community.

1. Every day
2. About twice a week
3. Once a week
4. Every other week
5. Other ---> Please specify:

Q12. When you do water your lawn, how long, on average, do you water a given area?

1. Less than 30 minutes
2. 30-45 minutes
3. 46-60 minutes
4. More than 60 minutes

Q13. Are you in the process of planting or renovating any part of the lawn on your property?

1. Yes
2. No
3. DK
4. RA

Q14. Last year, when your lawn was mowed, were the the clippings usually bagged?

1. Yes
2. No
3. DK
4. RA

Q15. How many trees in your lawn did you fertilize in 1990?

_ _ TREES

2. DK
3. RA

(DO NOT ASK Q16 IF Q3=2)
Q16. Did you take any measures to control aquatic weeds last year?

1. Yes
2. No
3. DK
4. RA

Now I have some questions about lawn fertilizers and weed killers.

Q17. In 1990, did your lawn receive any type of fertilizer or weed killer application?

1. Yes
2. No (GO TO Q34)
3. DK (GO TO Q34)
4. RA (GO TO Q34)

Q18. Who applied that fertilizer or weed killer to your lawn last year... was it a commercial applicator, you or someone else in your household, both a commercial applicator and you or other?

1. Commercial applicator (GO TO Q29)
2. You or someone else in the household
3. Both commercial and you
4. Other
5. DK
6. RA

Q19. Did you use a special organic mixture or did you use a standard fertilizer?

1. Special organic mixture
2. Standard fertilizer
3. DK
4. RA

Q20. What percent of your lawn did you treat with fertilizer last year?

_ _ _ %

2. DK
3. RA

Q21. What percent of your lawn did you treat with weed killer, including any spot treatments, last year?

_ _ _ %

2. DK
3. RA

Q22. Thinking back to <u>last spring</u>, did you apply any fertilizer or weed killer to your lawn?

1. Yes
2. No (GO TO Q23)
3. DK (GO TO Q23)
4. RA (GO TO Q23)

Q22A. How many times did you apply a combination of fertilizer and weed killer to your lawn last spring?

_ _ TIMES

2. DK
3. RA

Q22B. How many times did you apply fertilizer to your lawn last spring?

_ _ TIMES

2. DK
3. RA

Q22C. How many times did you apply weed killer to your lawn last spring?

_ _ TIMES

2. DK
3. RA

Q23. Now thinking back to last summer, did you apply any fertilizer or weed killer to your lawn?

1. Yes
2. No (GO TO Q24)
3. DK (GO TO Q24)
4. RA (GO TO Q24)

Q23A. How many times did you apply a combination of fertilizer and weed killer to your lawn last summer?

_ _ TIMES

2. DK
3. RA

Q23B. How many times did you apply fertilizer to your lawn last summer?

_ _ TIMES

2. DK
3. RA

Q23C. How many times did you apply weed killer to your lawn last summer?

_ _ TIMES

2. DK
3. RA

Q24. And, then for last fall, did you apply any fertilizer or weed killer to your lawn?

1. Yes
2. No (GO TO Q25)
3. DK (GO TO Q25)
4. RA (GO TO Q25)

Q24A. How many times did you apply a combination of fertilizer and weed killer to your lawn last fall?

_ _ TIMES

2. DK
3. RA

Q24B. How many times did you apply fertilizer to your lawn last fall?

_ _ TIMES

2. DK
3. RA

Q24C. How many times did you apply weed killer to your lawn last fall?

_ _ TIMES

2. DK
3. RA

Q25. And, is it accurate that you applied a combination of fertilizer and weed killer to your lawn a total of X times last year?

1. Yes
2. No (GO TO Q25A)
3. DK
4. RA

Q25A. How many times in total did you apply a combination of fertilizer and weed killer to your lawn last year?

_ _ TIMES

Q26. So, is it accurate that you fertilized your lawn a total of X times last year?

1. Yes
2. No (GO TO Q26A)
3. DK
4. RA

Q26A. How many times in total did you apply just fertilizer to your lawn last year?

_ _ TIMES

Q27. Is it also accurate that you applied weed killer to your lawn a total of X times last year?

1. Yes
2. No (GO TO Q27A)
3. DK
4. RA

Q27A. How many times in total did you apply just weed killer to your lawn last year?

_ _ TIMES

Q28. Was the number of times you applied fertilizer and weed killer to your lawn last year typical of how you've been caring for your lawn?

1. Yes
2. No (DESCRIBE)
3. DK
4. RA

(ASK Q29- ONLY IF Q18=1 or 3)

Q29. Which lawn care company did you hire in 1990? (DO NOT READ LIST)

1. Barefoot Grass (GO TO Q29A)
2. Chemlawn (GO TO Q29A)
3. Ever-Green (GO TO Q29A)
4. Green Stuff (GO TO Q29A)
5. Other (GO TO Q30A)
6. DK (GO TO Q30A)
7. RA (GO TO Q30A)

Q29A. (IF Q29=1,2,3 or 4) What was the name of the package of services you purchased from your lawn care company in 1990? (GO TO Q31)

2. DK (GO TO Q30A)
3. RA (GO TO Q30A)

Q30. Which of the following services did your lawn care company provide for you last year? (READ LIST)

		Yes	No	DK	RA
a.	Fertilized your lawn	1	2	3	4
b.	Weed control for your lawn	1	2	3	4
c.	Fertilized your trees	1	2	3	4
d.	Trimmed shrubs	1	2	3	4
e.	Mowed your lawn	1	2	3	4
f.	Plowed snow	1	2	3	4

Q31. (IF Q30A=YES) Was your lawn fertilized with a special organic mixture or with a standard fertilizer?

1. Special organic mixture
2. Standard fertilizer
3. DK
4. RA

Q32. How many applications of fertilizer and/or weed killer did your lawn care company make to your lawn last year?

_ _ APPLICATIONS

2. DK
3. RA

Q33. Was last year's lawn care service typical of the care your lawn has been receiving?

1. Yes
2. No (EXPLAIN)
3. DK
4. RA

Now I have a few questions about other issues.

Q34. How important is having a nice-looking lawn to you... would you say it's very important, somewhat important, not very important or not at all important to you?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
5. DK
6. RA

Q35. How important do you think it is to your neighbors to have well groomed lawns... would you say it's very important, somewhat important, not very important or not at all important to them?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
5. DK
6. RA

Q36. How great a health risk do you believe home lawn chemicals--both fertilizers and weed killers--are to adults and children, if label directions are followed? Would you say there is a high health risk, moderate health risk, or low health risk?

1. High health risk
2. Moderate health risk
3. Low health risk
4. DK
5. RA

Please tell me if you strongly agree, agree, disagree or strongly disagree with the following statements. (READ LIST.)

	SA	A	D	SD	DK	RA
Q37A. The dangers of groundwater pollution from nitrogen fertilizers have been greatly exaggerated.	1	2	3	4	5	6

Q37B. Not enough is being done to limit the harmful effects of chemicals <u>on farms</u>. 1 2 3 4 5 6

Q37C. Not enough is being done to limit the harmful effects of chemicals <u>in urban</u> <u>areas</u>. 1 2 3 4 5 6

And now I'm going to ask you a few questions about Lake Minnetonka.

Q38. In your opinion, how would you rate the water quality of Lake Minnetonka? (READ LIST)

1. Excellent
2. Good
3. Fair
4. Poor
5. DK
6. RA

Now, please tell me whether you strongly agree, agree, disagree or strongly disagree with these statements.

Q39A. Milfoil, a weed that forms dense mats in shallow water, is a problem in Lake Minnetonka. 1 2 3 4 5 6

Q39B. Algae, which makes a lake look like green soup,is a problem in Lake Minnetonka. 1 2 3 4 5 6

Q40. Which do you consider more of a problem for water quality in Lake Minnetonka, milfoil or algae?

1. Milfoil
2. Algae
3. Both
4. Neither
5. DK
6. RA

Before ending this interview, I have a few remaining background questions.

Q41. What is your zip code?

\- - - - -

2. DK
3. RA

Q42. Was your total household income in 1990 above or below $25,000?

1. Above (GO TO Q42A)
2. Below (GO TO Q42B)
3. DK (GO TO Q43)
4. RA (GO TO Q43)

Q42A. (IF ABOVE) I am going to mention several income categories. When I come to the category that describes your total household income before taxes in 1990, please stop me.

1. 25 to 30,000
2. 30 to 35,000
3. 35 to 40,000
4. 40 to 50,000
5. 50 to 60,000
6. 60 to 70,000
7. 70,000 or more
8. DK
9. RA

Q42B. (IF BELOW) I am going to mention several income categories. When I come to the category that describes your total household income before taxes in 1990, please stop me.

1. Under 5,000
2. 5 to 10,000
3. 10 to 15,000
4. 15 to 20,000
5. 20 to 25,000
6. DK
7. RA

Q43. How many people are living in your household now, including yourself?

_ _ PEOPLE

2. DK
3. RA

Q43A. (IF MORE THAN ONE) How many of these people are under 18?

_ _ PEOPLE UNDER 18 (IF NONE, GO TO Q44)

2. DK
3. RA

Q43B. (IF ONE OR MORE) How many of these are under 6?

_ _ PEOPLE UNDER 6

2. DK
3. RA

(ASK ONLY IF UNSURE)
Q44. Respondent is

1. Male
2. Female
3. DK

Thank you for answering these questions. I appreciate your time.